Lesson Introduction

“ Have you ever watched a bird soar through the sky or thrown a paper airplane and wondered why it flies the way it does? Today, we’re going to uncover the secrets that make flight possible! We’re going to learn about the Four Forces of Flight — the invisible powers that help airplanes, birds, and even rockets lift off the ground, zoom forward, and stay in the air. By the end of today, you’ll understand why some things fly really well… and maybe even how to make your own paper airplane fly farther than ever before!”

Almost everything that flies uses the **Four Forces of Flight** — lift, thrust, drag, and gravity — in some way.
Airplanes, helicopters, birds, and even insects all have to deal with these forces to get off the ground and stay in the air.

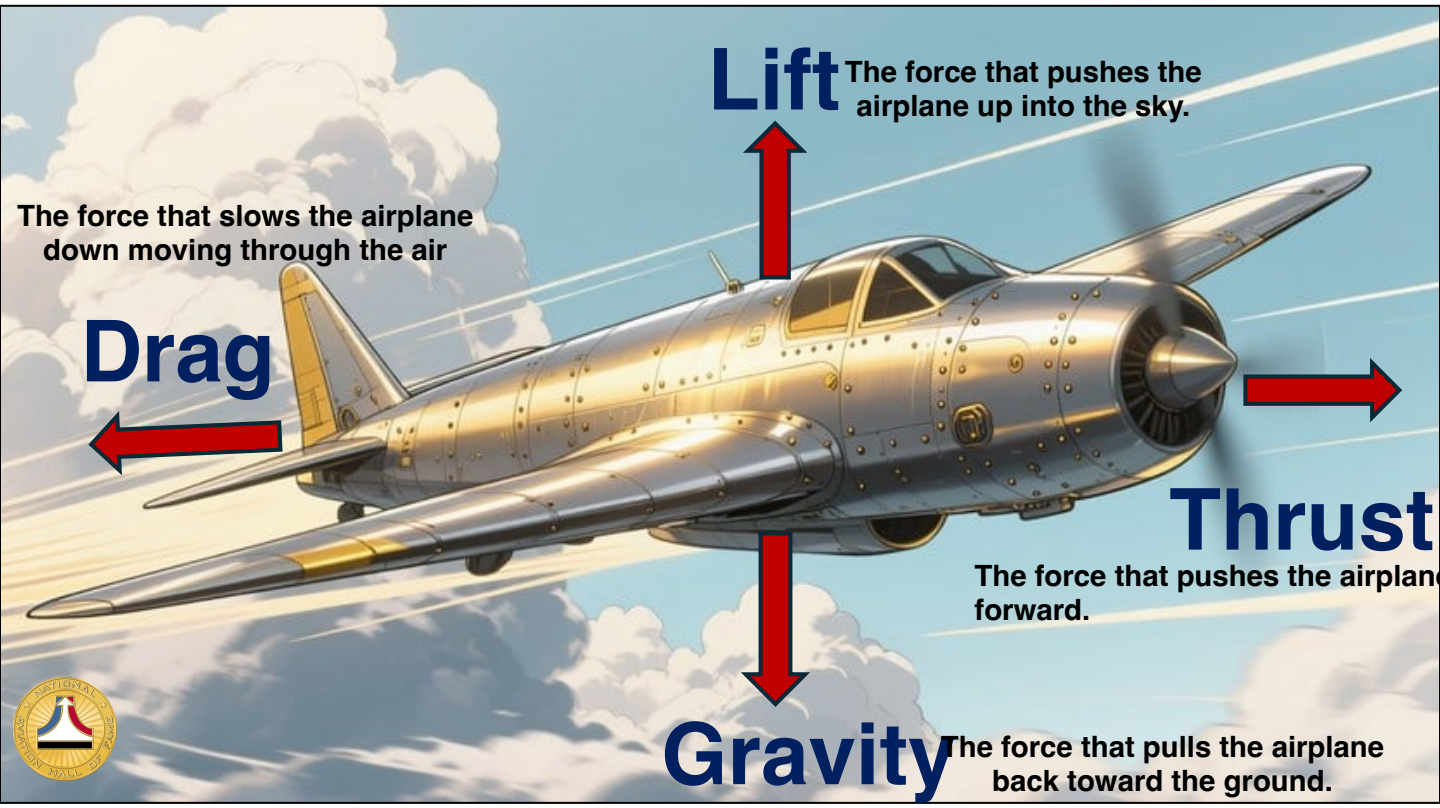
Today we are going to learn about the Four Forces of Flight! These are the forces that work together to help airplanes fly. The four forces are lift, thrust, drag, and gravity.

- **Lift** helps them go up.
- **Thrust** pushes them forward (like engines or wing flaps or bird wings flapping).
- **Drag** slows them down because air pushes back.
- **Gravity** pulls them down toward the earth.

The Four Forces of Flight

What Makes Airplanes Fly?

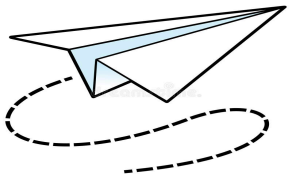
Lift, Drag, Gravity, and Thrust are the four forces that work together to help a heavy airplane fly through the sky. Let's explore what each force does and how they keep an airplane up in the air!



TEST YOUR KNOWLEDGE

1. **Circle** the force helps the airplane go up into the sky.
2. Put a **square** around the force that pushed the airplane forward.
3. Put a **star** next to the force that slows the airplane down.
4. **Underline** the force that pulls the airplane toward the ground.

he Paper Airplane Test



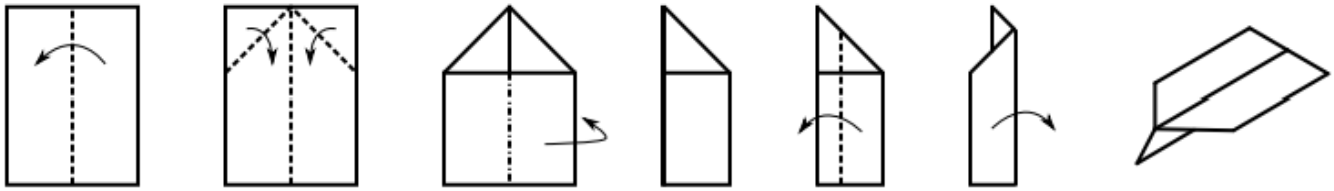
Tell Students:

Have you ever wondered why some paper airplanes fly really well and others do not? The way a paper airplane is folded and shaped can make a big difference. That is called the airplane's design.

In this activity, you will build your own paper airplane and try changing its design. Then you will see how those changes affect how the plane flies. You will also learn some cool science about the forces that help airplanes fly.

Instructions:

1. Explain step by step with students to build a paper airplane. Details **HERE**



2. Use masking tape on the floor to make a line to act as the starting line from which students will fly their paper plane.

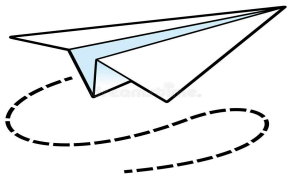
3. Have students place their toe on the starting line and t throw their paper airplane a few times. Observe how it flies and where it lands.

4. Once students know about how far their plane usually flies, they can change it to make more drag (which will slow it down).
    1. Students should cut four small slits along the back edge of the wings. Each slit should be about 1 inch long. Cut one in the middle of each wing. Cut one where each wing meets the center fold. This will make four tabs (two on each wing).

5. Have students throw their modified paper airplane at least 5 times and observe how far the plane flies compared to before.

The Four Forces of Flight

Lesson Review



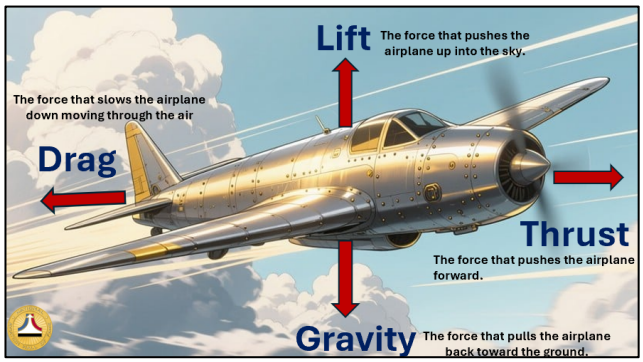
Explain what happened to students:

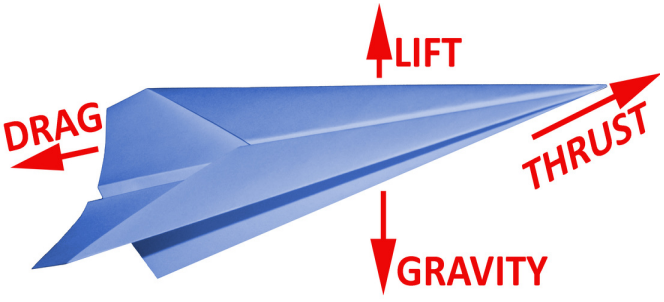
What Happened?

- When a paper airplane flies through the air, the air pushes against it and slows it down. This pushing force is called **drag**.
- Think about when you ride in a car and put your hand outside the window. If you hold your hand flat (like a plane's wing), the air pushes your hand a little bit. But if you turn your hand so it stands up straight, the air pushes your hand much harder.
- In this activity, you made little tabs on the wings of your paper plane that stick up like your hand held straight up. This made the plane catch more air and feel more drag, so it slowed down more than before.
- This shows that changing just one force can make a big difference in how a paper plane flies!

Tell Students:

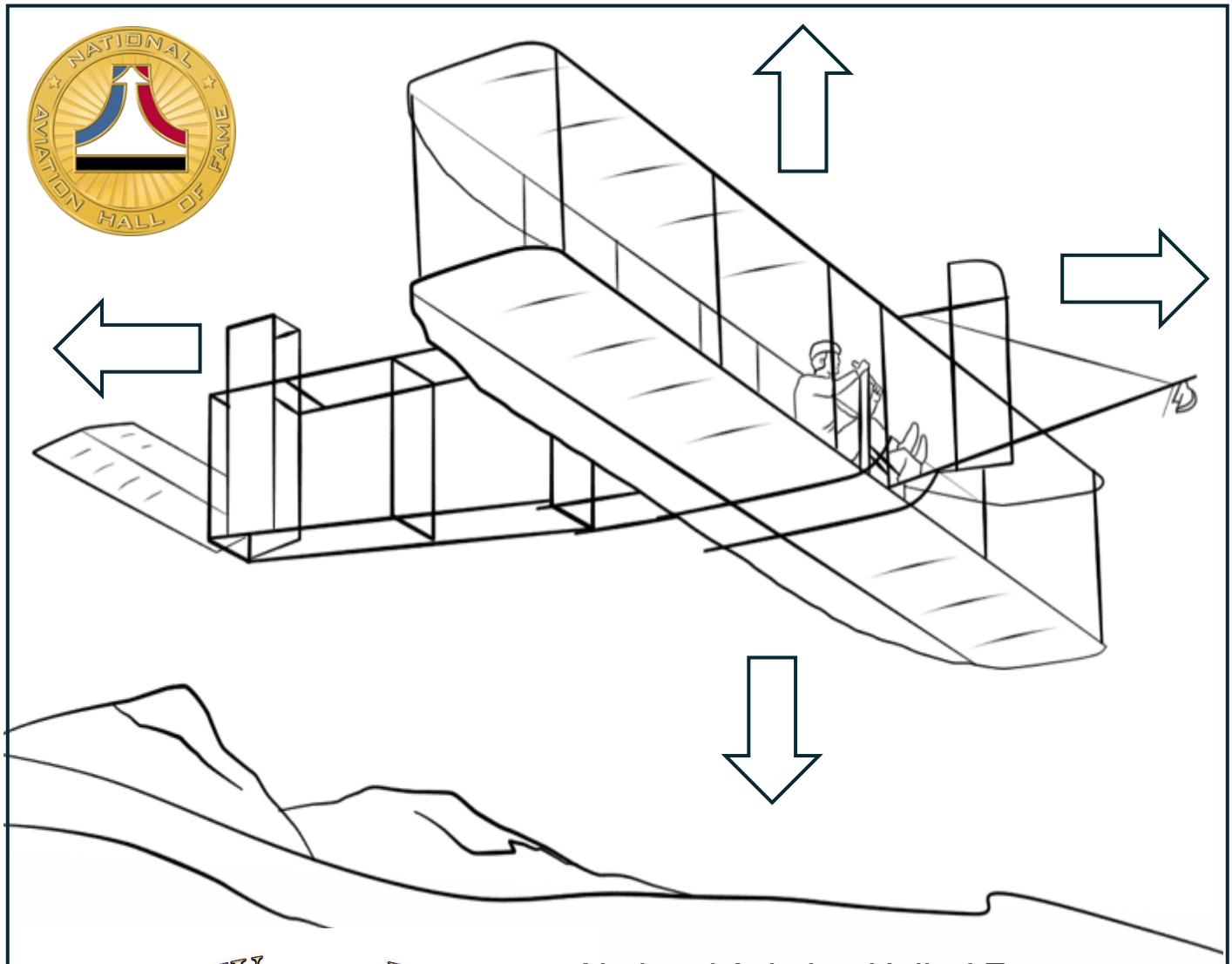
Let's look at our Four Forces of Flight worksheet to remember how all the forces work together to help a plane fly.





Support video to expend this lesson:

- A video from our friends at the Smithsonian National Air and Space Museum on the Four Forces of Flight
- A video from our friends at NASA that has the Wright Brothers explaining the Four Forces of Flight



National Aviation Hall of Fame Enshrinees understood the Four Forces Of Flight!

A long time ago, the Wright Brothers wanted to build the first airplane that could really fly. To do that, they had to understand the four forces of flight**: lift, thrust, drag, and gravity**.

By working with these four forces, the Wright Brothers made the first successful airplane that could fly and land safely. Their hard work showed how important it is to understand how these forces work together.

Can you identify each force that helped make their plane fly and color this picture.